

# ARCOS and Domain Speculus Guide

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## 1. Purpose of this Guide

This document provides an overview of the ARCOS-Speculus and the Domain-Speculus within ARCOS (AI Rule-Constrained Orchestration System). Domain-Speculus is the rule extraction and specification agent that bridges human intent and machine-readable rules. There are two complementary kinds of Speculus:

- ARCOS Speculus – managed by ARCOS itself, capturing project-level specifications and specific domain agents to use for the Speculus, Producer, Validator, Post-Processor and Output.zip Domain Filter.
- Domain Speculus – defined by each domain, capturing domain-specific rules and constraints.

Together, these layers ensure both global orchestration and domain knowledge are integrated into ARCOS flows.

## 2. ARCOS Speculus (Global)

The ARCOS Speculus operates at the system level. It handles the global specification of projects and coordinates with the Orchestrator (Maestro). Its responsibilities include:

- Capturing high-level project descriptions, Domain vocabulary, predefined Domain rules, Domain schemas (ARCOS\_Project.xml).
- Capturing how each domain agents are called, with the licensing information (ARCOS\_Domain\_Agents.xml)
- Managing project lifecycle: new project, edit project requests.
- Ensuring that the project references the correct domain schema and agents.
- Returning an ARCOS\_Speculus\_Response (success, cancelled) containing both the ARCOSProject and ARCOSSDomainAgents as inline elements.

The ARCOS Speculus therefore provides the backbone for orchestrating multiple domains while keeping global rules clear.

## 3. Domain Speculus (Domain-Oriented)

The Domain Speculus is specific to each domain. It extracts domain rules and custom constraints based on human input, domain vocabulary, domain schema and predefined rules. Its responsibilities include:

- Producing Current\_Project\_Rules.xml that encodes extracted rules and links them to UserIntents.
- Referencing Predefined\_Domain\_Rules.xml to enforce universal constraints.
- Supporting clarifications requested by the Orchestrator from the Validator and the Producer.
- Returning a Domain\_Speculus\_Response (success, cancelled), inserting the Current\_Project\_Rules as an inline element

Domain Speculus make ARCOS extensible: any industry, software stack, or business process can provide its own vocabulary, domain schema and predefined rule definitions, and ARCOS will orchestrate them consistently.

## 4. Speculus Workflow

Both ARCOS and Domain Speculus follow a structured workflow, with humans and AI collaborating in rule creation and validation:

1. User provides free-form project or domain description text.
2. AI parses the input and assigns UserIntents with unique IDs.
3. Each UserIntent is converted into a proposed rule.
4. The system checks whether each rule is new, an update, or a conflict.
5. The user reviews, accepts, modifies, or rejects each proposal.
6. Accepted rules are integrated into the canonical specification (ARCOS or Domain).
7. Each rule is linked back to its UserIntent for traceability.

This workflow ensures that every extracted rule is traceable from raw user input to final system specification.

## 5. Example: BLEU Inventory Domain

In the BLEU inventory domain, the Domain Speculus extracts rules such as ensuring eco-certification, enforcing origin tracking, and validating thread types. These are stored in `Current_Project_Rules.xml`. Predefined rules, such as unique IDs and required dimensions, are stored in `Predefined_Domain_Rules.xml`. Those documents reference the `Domain_Vocabulary.xml` to link it all.

The ARCOS Speculus manages the overall project, linking the BLEU domain schema (`bleu_parts_v5.xsd`) and its rules to the project specification. This allows the Orchestrator to coordinate Producer and Validator steps seamlessly.

## 6. Benefits of the Speculus Layer

The Speculus layer introduces several key advantages:

- Clear separation of global orchestration and domain-specific rule extraction.
- Human-in-the-loop review ensures correctness and trust.
- Full traceability from UserIntents to accepted rules.
- Extensible to any domain by publishing domain schemas and rules.
- Enforces consistent workflows across industries and technologies.

## 7. Conclusion

Speculus is the rule extraction heart of ARCOS. By distinguishing between ARCOS Speculus (global) and Domain Speculus (domain-specific), ARCOS combines orchestration with extensibility. This design makes ARCOS applicable to countless real-world domains, laying the foundation for schema-driven AI specification as a new field.